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Taxilejeunea pterogonia and certain allied species*

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(WITH PLATE 2 AND TWENTY-TWO TEXT FIGURES)

The genus *Taxilejeunea* includes some of the largest and most conspicuous of the Lejeuneae with bifid underleaves. Some of the species abound in tropical regions, especially in mountainous localities, and sometimes form broad mats, with or without admixture, on rocks, banks and other suitable substrata. The color is usually a pale yellowish or whitish green, contrasting with the surrounding vegetation. In spite of their large size the plants give an impression of great delicacy. When dry the leaves tend to roll themselves about the stem but, when moist, spread out more or less widely. The lobules, when normally formed, are inflated and show a hyaline papilla at the base of the apical tooth, agreeing in this respect with *Lejeunea*, *Rectolejeunea*, *Pycnolejeunea* and other genera of the Lejeuneae Schizostipae. Unfortunately the lobule is often reduced to a minute basal tooth and fails to exhibit any distinctive features. The underleaves are unusually well developed and sometimes approach or even equal the leaves in size; in other cases they are distinctly smaller.

One of the most distinctive features of the genus is found in the branches which bear the female inflorescences. In typical cases these are short and have distinctly smaller leaves than the stem. The female inflorescence invariably innovates, commonly on one side but occasionally on both, and the innovations are usually short and soon brought to an end by another inflorescence. In this way more or less complicated branch-systems of a cymose character are formed. In many cases the branch-system forms a distinct sympodium with the inflorescences ranged along its upper side. In some of the species which have been referred to *Taxilejeunea*, the described conditions are not clearly exhibited.

* Contribution from the Osborn Botanical Laboratory.

The female inflorescence, for example, may be borne on a long branch with large leaves, or the innovation of the first inflorescence formed may be sterile. In such cases the systematic position may be one of great uncertainty.

The bracts in *Taxilejeunea* tend to be smaller and narrower than the stem leaves, and the lobules, which are always much smaller than the lobes, are often reduced to vague basal folds, which are scarcely apparent when the bracts are spread out flat. In other cases the apices of the bracts are distinct, and much variation is sometimes found even in a single species. The bifid bracteoles are usually broader than the bracts and often equal them in length. The perianths exhibit great diversity in the different species and considerable variation in a single species is sometimes encountered. The lower part is almost always terete, and this condition may extend throughout the length of the organ, being evident even in the inflated apical portion. In other cases the perianth is five-keeled, the keels extending to below the middle or restricted to the upper part. The keels, in turn, may be smooth or variously toothed and winged. In old and battered perianths the true features are sometimes greatly obscured.

The species discussed in the present paper are all typical members of the genus. They all show leaves which are cordate or auriculate at the base, more or less sharp-pointed at the apex, crenulate throughout and often vaguely toothed in the apical portion; and their underleaves are large, cordate or auriculate at the base and shortly bifid. They are all further distinguished by their sharply five-keeled perianths, the keels in the first three being more or less distinctly winged and toothed. In the fourth species, which is clearly a close ally of the others, the keels are smooth or vaguely crenulate.

- I. TAXILEJEUNEA PTEROGONIA (Lehm. & Lindenb.) Schiffn.
Jungermannia pterogonia Lehm. & Lindenb. in Lehmann, Pug.
Plant. 6: 44. 1834.
Omphalanthus pterogonius Lehm. & Lindenb. in G. L. & N. Syn.
Hep. 306. 1845.
Omphalanthus subalatus Lindenb. & Gottsche in G. L. & N. Syn.
Hep. 747. 1847.

Lejeunea (Taxi-Lejeunea) pterogonia Spruce, Trans. Bot. Soc. Edinburgh 15: 216. 1884.

Taxilejeunea pterogonia Schiffn. in Engler & Prantl, Nat. Pflanzenfam. 13: 125. 1895.

Pale green, often becoming yellowish or brownish with age, growing in loose mats and often mixed with other bryophytes: stems mostly 0.15–0.2 mm. in diameter, irregularly and usually sparingly branched, the branches obliquely to widely spreading, sometimes long and similar to the stem but often short, invariably so if sexual: leaves loosely imbricated, the lobe obliquely spreading, plane to strongly convex, scarcely falcate, ovate, mostly 0.8–1 mm. long and 0.55–0.75 mm. wide when well developed, dorsal margin arching across the stem and conspicuously auriculate at the base, slightly curved in the outer part, ventral margin slightly curved and forming a wide angle with the keel, apex acute or apiculate and often tipped with a row of two cells, margin slightly and minutely crenulate from projecting cells, sometimes with one or two larger and sharper teeth in the vicinity of the apex; lobule when well developed inflated throughout, ovoid, about 0.15 mm. long and 0.1 mm. wide, keel straight to slightly arched, free margin involute to beyond the apex, sinus very short, shallowly lunulate (in spread out lobules), apical tooth an almost straight, scarcely projecting rounded cell; lobule often imperfectly developed but usually evident; cells of lobe about 16 μ in width along the margin, 32 x 24 μ in the middle, and 40 x 24 μ at the base, thin-walled but with distinct (and sometimes confluent) trigones and intermediate thickenings, the latter sometimes two in number in a long lateral wall, cuticle covered over with exceedingly minute, dot-like verruculae: underleaves loosely imbricated, convex (from below), the lateral margins often more or less involute, orbicular, mostly 0.6–0.9 mm. long, bifid one fourth to one third with a narrow, usually sharp sinus and broad, subacute, often contiguous or overlapping divisions, distinctly auriculate at the base, the auricles usually contiguous or overlapping, margin minutely crenulate throughout as in the leaf-lobes: inflorescence autoicous: ♀ inflorescence usually borne on a very short branch but sometimes on a somewhat elongated branch, innovating on one side, the first innovation usually at once floriferous, the second sometimes floriferous but more frequently sterile; bracts slightly spreading, scarcely keeled, the lobe straight (not falcate), ovate, mostly 0.55–0.65 mm. long and 0.25–0.3 mm. wide, acute and usually coarsely and irregularly toothed, the teeth sharp or blunt, rarely more than three or four, lobule in some cases distinct, 0.2–0.3 mm. long and 0.07 mm. wide with an acute apex, but usually narrower and sometimes

very indistinct; bracteole slightly connate with the bracts, obovate or oblong, mostly 0.55–0.65 mm. long and 0.35–0.4 mm. wide, bifid about one third with a narrow acute sinus and erect, acute or subacute divisions, the margins crenulate as in the underleaves and often bearing in addition one or two sharp or blunt teeth on the sides; perianth more or less exserted, sometimes for about half its length, broadly to narrowly obovoid, mostly 0.5–1.2 mm. long and 0.35–0.4 mm. wide, cuneate toward the base and truncate at the apex with a short but distinct beak, sharply five-keeled in the upper half or third, the keels more or less distinctly winged and the wings sharply dentate or spinose, the number of teeth or spines on each wing usually from one to four: ♂ inflorescence occupying a short branch or, rarely, a subfloral innovation, apparently never proliferating; bracts mostly in two to six pairs, imbricated, much smaller than the vegetative leaves, strongly inflated, shortly bifid with blunt lobes and a strongly arched keel; antheridia in pairs; bracteole usually single and very small, ovate, bifid about one half with subacute divisions: mature capsule about 0.25 mm. in diameter. [PLATE 2.]

On earth and rocks; widely distributed in the American tropics. The specimens cited include all that the writer has personally examined. Other records for the species are noted in connection with its history.

GUATEMALA: near Coban, Alta Verapaz, February, 1886, *H. von Türrckheim* 11 (specimens determined by Stephani and distributed by Levier; they are unfortunately sterile and therefore somewhat uncertain).

JAMAICA: near Mabess River, April, 1903, *W. R. Maxon* 1562; vicinity of Moody's Gap, September, 1908, *E. G. Britton* 916.

VENZUELA: Paramo de la Culata, province of Merida, *J. Linden* 574 (Mitten Herbarium).

COLOMBIA: Andes of Bogota, *W. Weir* (Mitten Herbarium).

ECUADOR: Canelos, *R. Spruce* (distributed in Hepaticae Spruceanae); Quito, *Jameson* (Mitten Herbarium, under the name *T. chimborazensis* Spruce); near Quito, 1914, *G. Hammond* 3 (specimen received from W. Ingham).

PERU: San Miguel, July, 1911, *H. W. Foote* (listed by the writer in Trans. Connecticut Acad. 18: 315. 1914); same locality, June, 1915, *Cook & Gilbert* 1179, 1180; Torontoy, July, 1915, *Cook & Gilbert* 1778.

BOLIVIA: without collector's name, date or definite locality

(Mitten Herbarium, specimen received from Montagne—labeled "*Omphalanthus debilis* . . . Peruvia"—but presumably collected by D'Orbigny in Bolivia); Yungas, June and July, 1893, *P. Jay* 2, 13, 16, 119.

This interesting species was based on a specimen from Peru in the Kunze Herbarium, neither the collector's name nor the definite locality being mentioned in the original description. This specimen was fortunately fertile and Lehmann and Lindenberg describe the perianth as turbinate and five-angled at the apex, the angles growing out into ciliate crests. Other important characters of their *Jungermannia pterogonia* did not escape them: they call attention to the cordate-ovate leaves, apiculate at the apex and often minutely denticulate in the upper part; to the minute lobules, which they describe as almost obsolete; to the cordate-orbiculate underleaves, acutely and very narrowly "emarginate" at the apex but otherwise entire; to the very short female branches; to the "lanceolate," acute, "denticulate" bracts; and to the bifid, "serrate-denticulate" bracteoles.

In the Synopsis Hepaticarum the arrangement of the perianths in a second series is emphasized; otherwise the original description is transcribed, almost word for word. In addition to the original Peruvian specimen, however, the authors cite a Mexican specimen under *Omphalanthus pterogonius*, although here again neither the collector's name nor the definite locality is mentioned.

The next allusions in the literature to *T. pterogonia* are apparently in the writings of Gottsche. In his "Mexikanske Levermosser," published in 1863, he refers the Mexican specimens which the Synopsis had included under *O. pterogonius* to *O. subalatus* Lindenb. & Gottsche,* a species based on Mexican material from Mirador, collected by F. Liebmann.† In this species the perianth is described as cylindrical-turbinate and pentagonal at the apex, the angles being "subalate" but smooth. No other differential characters of much significance are brought out. In his chapter on the Hepaticae in Triana and Planchon's "Prodromus Florae Novo-Granatensis," published the following year, Gottsche cites the true *O. pterogonius* from Aserradero and

* Kong. Dansk. Vidensk. Selsk. Skr. V. 6: 274. 1863.

† G. L. & N. Syn. Hep. 747. 1847.

Cipacon, two stations in the vicinity of Bogota, Colombia, the collector in both instances being A. Lindig.* Here, for the first time, a monoicous inflorescence is ascribed to the species.

Next in order is the full and careful account by Spruce in his "Hepaticae of the Amazon and of the Andes," which appeared in 1884. He emphasizes particularly the cordate or auriculate features of the leaves and underleaves, describing the auricles of the leaves as "rotundo-circinata;" and those of the underleaves as "forficato-imbricata." He alludes, moreover, to the small leaves and underleaves of the female branches and states that each innovation bears "only a single row of them below the flower." He describes the leaves as "pauciserrulata" (with about four teeth) in the vicinity of the apex, and implies that the lobule is always very minute. With regard to the bracts he makes no mention of the lobule but states that the lobe varies from oblong to ovate-lanceolate, the upper portion being more or less serrate. The perianth he describes as five-angled in the upper part with winged angles, the wings being extended as "laciniato-ciliatove-cristata" horns. Spruce cites the species from the Pastasa River, Ecuador, *R. Spruce*; from Mount Campana, Peru, *R. Spruce*; and from Caldas, Brazil, *G. A. Lindberg*. He notes also its earlier collection in Peru and Mexico, apparently ignoring Gottsche's statements regarding the Mexican specimens.

It will be seen that definite and well-authenticated records for *T. pterogonia* up to this time are restricted to scarcely half a dozen localities in South America. The researches of Stephani, however, brought a few additions to the list. In his revision of the "Gattung *Lejeunea* im Herbarium Lindenberg." published in 1890, he quotes the species from Peru (the original Kunze specimens) and also from the following stations: Mirador, Mexico, *Liebmann 262, 326*; Merida and Tovar, Venezuela, *Moritz*.† The Mexican specimens represent *Omphalanthus subalatus*, which, in Stephani's opinion, is a form of *O. pterogonius* with entire leaves. He thus differs from Gottsche who found the differential characters in the perianths. Some of the Venezuela specimens are listed in the Synopsis under the name *O. debilis* γ* *columbicus*; the others

* Ann. Sci. Nat. Bot. V. 1: 147. 1864.

† Hedwigia 29: 12, 13. 1890.

bear the incorrect name *O. apiculatus* Gottsche in the Lindenberg Herbarium. Stephani has since cited *T. pterogonia* from Chenim de Carillo, Costa Rica, *Pittier 6064*.* In 1913 he described the habitat of the species as, "*America tropica*, valde communis,"† but this scarcely seems warranted from the scanty records in the literature.

The writer, as already noted, has recently recorded *T. pterogonia* from San Miguel, Peru, but regrets that he has been unable to confirm any of the other published records for the species. The large series of specimens listed above has, however, been available for study and this has included named material from Ecuador in Spruce's *Exsiccatae* (not alluded to in his book) and named material from Colombia in the Mitten Herbarium. This material and the other specimens listed clearly represent the same specific type.

In describing a variable species it is always difficult to do justice to its range of variability and at the same time to distinguish it clearly from its allies. This is strikingly the case with *T. pterogonia* and other members of this difficult genus. When fertile and well-developed specimens are examined their specific characters seem to be above question, but marked variations are often encountered, even in a single plant, and tend to obscure the specific limitations. These variations affect particularly the size and vigor of the plants, the form and marginal features of the leaf-lobes and underleaves, and the characters derived from the involucre leaves and underleaves. In the case of sterile material a positive determination is always difficult and may be quite impossible.

According to Stephani the stems of *T. pterogonia* sometimes attain a length of 10 cm. In the writer's experience they rarely surpass 4 cm. in length, although a greater development would not be surprising. Stephani's measurements of the leaves and underleaves are likewise a little high and must have been drawn from unusually vigorous plants. According to his description the leaves are 1.67 mm. long and 1.33 mm. wide, while the underleaves measure 1 x 1.33 mm. Spruce gives 1.1 x 1 mm. for the

* Bull. Soc. Roy. Bot. Belgique 31: 180. 1892.

† Spec. Hepat. 5: 476. 1913.

leaves and 1-1.1 x 1-1.1 mm. for the underleaves, while the writer's measurements are even lower. In many instances the stems are simple or very sparingly branched until the short sexual branches are formed, but long branches essentially like the stem are not infrequent and sometimes completely change the aspect of a plant.

The earlier writers describe the leaves as semivertical or "sub-semivertical," but FIGS. 1-3 show that they spread at an angle of about 45 degrees and that Stephani is correct in describing them as "oblique patula." The same figures show the inconstancy of teeth in the apical region; many of the leaves are entire throughout, except for the very vague marginal crenulations (shown in FIG. 5), and none of the leaves figured show more than two teeth. In rare cases the writer has observed three teeth but never a higher number, although Spruce gives the number of teeth as about four. The basal auricle of the lobe, emphasized by both Spruce and Stephani, is clearly shown in FIG. 3. The published descriptions all insist that the lobule is exceedingly minute and rudimentary, and this is probably its usual appearance. Not infrequently, however, distinctly inflated lobules are present and conform to the type distinctive of the genus. Such lobules are shown in FIGS. 1 and 2, while FIG. 6 shows the apical portion, with its short rounded tooth and proximal hyaline papilla.

The leaf-cells deserve rather more attention than has previously been given them. Spruce describes them as "leptodermes," without mentioning the trigones, while Stephani states merely that the trigones are small. FIG. 4 shows that both trigones and intermediate thickenings are present and that they often show bulging sides. Sometimes the thickenings are less marked than in the cells figured, and the trigones may even show concave sides; but apparently distinct thickenings form a characteristic feature of the cells. Another feature, which earlier writers seem to have overlooked, is found in the dot-like verruculae scattered over the free walls of the cells. They are exceedingly minute, measuring less than a micromillimeter in diameter and can be made out only by careful observation.

The underleaves exhibit in a marked degree the highly arched line of attachment which is characteristic of the more typical

species of *Taxilejeunea*. This is brought out in FIGS. 1 and 2, which likewise show the striking basal auricles. In most cases these are so large that they closely approach each other or even overlap. The single auricle shown in FIG. 8 indicates the vaguely crenulate margin found in the underleaves as well as in the leaves. The apical incisions, as shown in the figures, are sometimes a little deeper than the published descriptions imply, while the lobes are subacute or even subobtusely rather than invariably acute, but these discrepancies are slight and of but little significance.

The branch-system upon which the female inflorescences are borne is less complex and subject to less variability than in many other species. In the majority of cases (see FIG. 1) the branch bears one or two small underleaves, with their corresponding leaves, and then proceeds at once to form an archegonium with its involucre leaves; from the base of the inner bract a subfloral innovation arises and bears a second female inflorescence after producing a single small underleaf and a single leaf. The innovation arising from this second flower is usually sterile and may be very short; sometimes, however, it gives rise to a third inflorescence which in turn gives rise to a sterile innovation. The writer has observed no instance in which more than three inflorescences of successive orders were present on a branch-system, although it would not be surprising if more were occasionally developed. When perianths are present, the system presents the appearance of a short branch with two or three closely approximated perianths along its upper side. Deviations from this condition are of occasional occurrence; sometimes, for example, the original branch bears several to many leaves before its growth is brought to an end by the development of an archegonium; sometimes (see FIG. 2) an innovation will bear two (rarely three) underleaves and three (rarely five) leaves (instead of one of each); sometimes the first inflorescence gives rise to two innovations, each of which is tipped with an archegonium; sometimes a subfloral innovation develops as a male spike. These deviations are not infrequent and probably others could be detected by careful search, and yet the type first described occurs so often that it may be regarded as distinctive of the species.

The bracts and bracteoles represented (FIGS. 9-18) show a

considerable range of variation. FIG. 9 illustrates the first involucre of a branch-system taken from a Peruvian specimen and brings out the fact that there is a slight coalescence between the bracteole and the bracts and also between the bracts themselves. In the bract on the left the basal tooth represents the lobule but the next tooth is even larger and more sharply pointed; the other teeth are much smaller, several of them being nothing more than projecting cells. The other bract shows similar teeth, the lobule (the basal tooth) being much like the others; the bracteole is unidentate on each side. FIGS. 10-12 illustrate the bracts and bracteole of the second inflorescence of the same branch-system; FIG. 13, the bracts and bracteole of the first inflorescence of another branch-system from the same material; FIGS. 14 and 15, one bract and the bracteole of the second inflorescence of this second branch-system; and FIGS. 16-18, the bracts and bracteole of an inflorescence taken from a Jamaican specimen. It is not necessary to describe these in detail, but the unusually large lobule in the left-hand bract of FIG. 13 should be noted and also the approach to an entire condition shown in FIG. 17. There is perhaps a tendency for the first inflorescence of a system to develop more strongly dentate bracts with larger lobules than the succeeding inflorescence or inflorescences, but this tendency is too vague to be insisted upon. Bracts which are absolutely toothless and which show scarcely a sign of a lobule occasionally occur (although none are figured); they are commonly associated with the second or third inflorescence of a system, but even the first inflorescence sometimes shows bracts of this character.

The perianth is characterized by the dentate to spinose wings borne on its five sharp keels (FIGS. 1, 2 and 19). These wings may be either continuous or once or twice interrupted and rarely exceed ten cells in length or three in width; sometimes a second, less well-developed wing may be found on a single keel. The teeth borne on the margin of the wing vary greatly; from one to four teeth are commonly present and these vary from one to four cells in length and from one to three cells in width at the base; they may therefore be slender cilia, broad triangular lobes, or short slightly projecting cells or groups of cells. The beak is short and relatively broad, consisting of two or three superimposed circles of cells.

2. *Taxilejeunea jamaicensis* sp. nov.

Pale whitish or yellowish green, growing in loose mats and often mixed with other bryophytes; stems mostly 0.15–0.18 mm. in diameter, irregularly but often copiously branched, the branches obliquely to widely spreading, often copiously branched, the branches obliquely to widely spreading, often long and similar to the stem but sometimes with smaller leaves even if not sexual: leaves loosely imbricated, the lobe obliquely spreading, plane to strongly convex, scarcely falcate, ovate, mostly 0.75–1.2 mm. long and 0.5–0.9 mm. wide when well developed, dorsal margin arching across the stem and usually distinctly auriculate at the base, slightly curved in the outer part, ventral margin slightly curved and forming a wide angle with the keel, apex acute or apiculate and often tipped with a row of two cells, margin slightly and minutely crenulate from projecting cells, sometimes with one or two larger and sharper teeth in the vicinity of the apex; lobule inflated throughout, ovoid, about 0.15 mm. long and 0.1 mm. wide when well developed, keel straight to slightly arched, free margin involute to beyond the apex, sinus very short, shallowly lunulate (in flattened out lobules), apical tooth an almost straight, slightly projecting rounded cell; lobule often imperfectly developed and sometimes scarcely evident; cells of lobe about $19\ \mu$ wide along the margin, $36 \times 27\ \mu$ in the middle and $38 \times 27\ \mu$ at the base, thin-walled but with distinct (and rarely confluent) trigones and intermediate thickenings, the latter very rarely more than one in each wall, cuticle covered over with exceedingly minute, dot-like verruculae: underleaves contiguous to loosely imbricated, convex (from below), the lateral margins often involute, orbicular, mostly 0.6–1 mm. long, bifid one fourth to one third with a narrow, usually sharp sinus and broad bluntly pointed or subacute, often contiguous or slightly overlapping lobes, distinctly auriculate at the base when well developed (but sometimes only cordate or rounded), the auricles often contiguous but rarely overlapping, margin as in the leaf-lobes: inflorescence autoicous: ♀ inflorescence sometimes borne on a very short branch but often on a more or less elongated branch, innovating on one side (or very rarely on both sides), the first innovation often floriferous but rarely immediately so, sometimes sterile (and rarely male), the second and one or more of the succeeding innovations not infrequently floriferous also; bracts slightly spreading, keel rounded, the lobe straight, scarcely if at all falcate, ovate to oblong, mostly 0.6–0.9 mm. long and 0.25–0.4 mm. wide, bluntly pointed to acute, sometimes coarsely and irregularly toothed, sometimes merely sinuate, the teeth when present usually blunt, rarely more than three or four, lobule in some cases distinct even in bracts spread out flat, 0.2–0.25 mm.

long and 0.06–0.09 mm. wide, the apex often discrete and sharp but sometimes scarcely evident; bracteole free or nearly so from the bracts, obovate or oblong, mostly 0.6–0.65 long and 0.35–0.45 mm. wide, bifid one fourth to one third with a narrow subacute to rounded sinus and erect acute or subacute divisions, the margins crenulate as in the underleaves and often bearing in addition a sharp or blunt tooth on one or both sides; perianth more or less exserted, sometimes for about half its length, obovoid, mostly 0.65–0.9 mm. long and 0.25–0.4 mm. wide, cuneate toward the base and truncate at the apex with a short but distinct beak, five keeled in the upper fourth or third, the keels very variable, sometimes rounded and sometimes sharp, in the latter case often winged, the wings sometimes narrow and interrupted, sometimes broader and continuous, entire or bearing one or two sharp or blunt marginal teeth: ♂ inflorescence occupying a short branch or, rarely, a subfloral innovation, very rarely terminating an elongated branch, apparently never proliferating; bracts, antheridia, and bracteoles as in *T. pterogonia*. [TEXT-FIGS. I–II.]

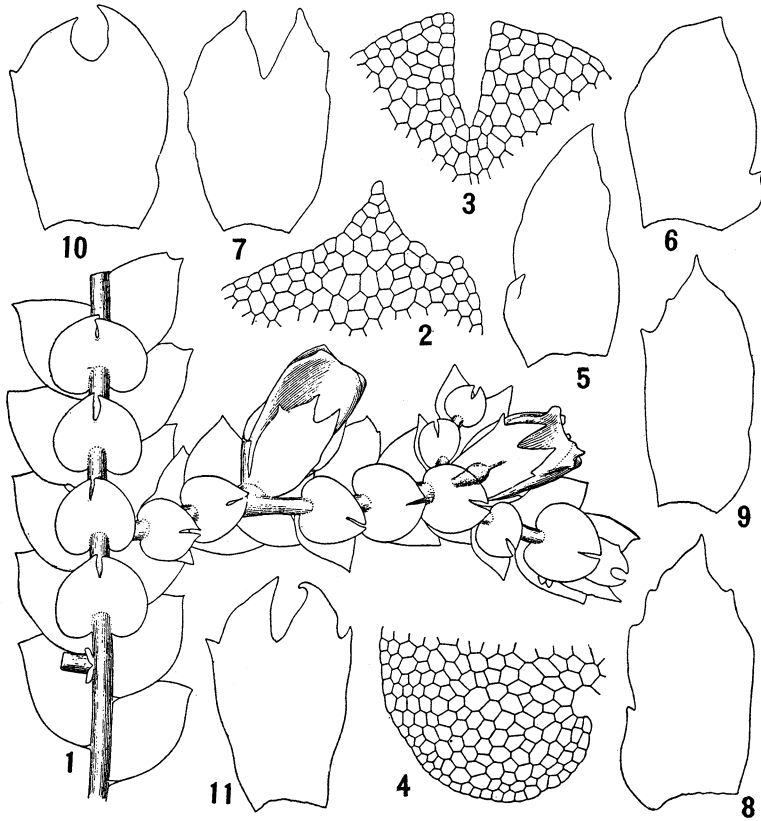
On banks and rocks, known with certainty only from Jamaica. The following specimens have been examined:

JAMAICA: without definite locality, *O. Swartz* (specimen labeled "*Jungermannia debilis*" in the Mitten Herbarium, received from the Hooker Herbarium); Cinchona, January, 1903, *L. M. Underwood* 241; same locality, October, 1908, *E. G. Britton* 1062; trail from Cinchona to Morce's Gap, January and February, 1903, *L. M. Underwood* 255, 1231; Clyde River Valley, January, 1903, *L. M. Underwood* 402; same locality, July, 1903, *A. W. Evans* 3, 8, 9, 13, 18; same locality, August, 1906, *A. W. Evans* 357; Morce's Gap and vicinity, February, 1903, *L. M. Underwood* 1408, 1420; same locality, May, 1906, *D. S. Johnson* 49; Mount Diabolo, April, 1903, *L. M. Underwood* 1847; Hardware Gap and vicinity, April, 1903, *L. M. Underwood* 2250; same locality, July, 1903, *A. W. Evans* 205 in part; same general locality, March, 1920, *Maxon & Killip* 1267; St. Catherine's Peak and vicinity, August, 1906, *A. W. Evans* 431.

No. 13, from Clyde River Valley, collected by the writer, may be designated the type.

The most important distinctions between *T. jamaicensis* and *T. pterogonia* are apparently those derived from the female branch-systems. In *T. pterogonia* these usually exhibit but little variation as already brought out, but in *T. jamaicensis* the range

of variability is greater and there seems to be no special type which is more or less closely approximated. In the plant figured (FIG. 1) the branch developed three underleaves (one of which has been dissected away) with the corresponding leaves before



TAXILEJEUNEA JAMAICENSIS Evans

1. Part of a stem showing a female branch-system, ventral view, $\times 25$. 2. Apex of lobe, $\times 90$. 3. Apex of underleaf, $\times 90$. 4. Basal auricle of underleaf, $\times 90$. 5-7. Bracts and bracteole from a single inflorescence, $\times 45$. 8-10. Bracts and bracteole from another inflorescence, $\times 45$. 11. Bracteole from a third inflorescence, $\times 45$. The figures were all drawn from the type specimen.

the first inflorescence; the single innovation of this inflorescence bore three more underleaves with their corresponding leaves and then a second inflorescence with two subfloral innovations; one of the latter was short and sterile, but the other developed a

third inflorescence with a single sterile innovation after bearing two underleaves with their corresponding leaves. A female branch system on another specimen (*Evans 3*) bore eight underleaves before the inflorescence, and the latter showed a single long sterile innovation with sixteen distinct underleaves. Another branch-system on the same specimen bore the first inflorescence after only two underleaves; the single innovation gave rise to eleven underleaves and a male branch before bearing a second inflorescence; and this in turn gave rise to a single long sterile innovation with ten distinct underleaves. These examples, selected more or less at random, will give some idea of the variations encountered and indicate that long branches and long subfloral innovations are of frequent but by no means of constant occurrence.

The other distinctions between *T. pterogonia* and *T. jamaicensis* are likewise associated with the greater variability of the latter species. The characters derived from the leaves, underleaves and floral parts are similar to those of *T. pterogonia* but less definitely realized. In the leaves, for example, the auricles at the base, although often as distinct as in *T. pterogonia*, are sometimes less marked; the thickenings of the leaf-cells tend to be less developed, and the surface-verruculae are often more difficult to demonstrate. The auricles of the underleaves may likewise be very distinct (FIG. 4), but the same specimen (FIG. 1) will often show underleaves which are rounded at the base. In the bracts (FIGS. 5, 6, 8 and 9) the teeth are usually much less distinct, and bracts with entire margins are of more frequent occurrence, while the bracteoles (FIGS. 7, 10 and 11) show no differences of importance. It is in the perianths, however, that the greatest range of variability is met with. Of the perianths figured (FIG. 1) the one at the left is almost beakless and the wings of the angles are reduced to scattered projecting cells; the perianth at the right shows a distinct beak and interrupted wings two cells wide on the two ventral keels, these wings bearing rounded teeth; the lateral and dorsal keels of this same perianth (not clearly shown in the figure) bear very narrow, indistinct and entire wings. In one perianth on another specimen (*Evans 3*) the short wings on the ventral keels run out into sharp points, but the dorsal and lateral keels are scarcely winged at all; in another perianth

on the same stem the wings on the two lateral keels and on one ventral keel run out into points, the dorsal keel and the other ventral keel being almost wingless; in a third perianth on the same stem all five keels bear more or less pointed wings. The perianths described include the most complex wings observed, and it will at once appear that these never exhibit the sharply dentate or ciliate condition so often found in *T. pterogonia*, although the less complex conditions of that species may be approached.

3. *Taxilejeunea densiflora* sp. nov.

Pale yellowish or whitish green, growing in loose mats, pure or in admixture with other bryophytes: stems mostly 0.2–0.25 mm. in diameter, irregularly branched, the branches mostly shorter and with smaller leaves than the stem, usually bearing sexual organs and sometimes more or less subdivided: leaves loosely imbricated, the lobe obliquely spreading, plane to somewhat convex, scarcely falcate, ovate, mostly 1–1.5 mm. long and 0.8–1.2 mm. wide when well developed, dorsal margin arching across the stem and rounded to cordate at the base, slightly curved, ventral margin slightly curved and forming a wide angle with the keel, apex rarely obtuse, mostly acute or apiculate and occasionally tipped with a row of two cells, margin minutely but distinctly crenulate from projecting cells especially toward the apex and occasionally with one or two larger blunt or sharp teeth in this vicinity; lobule inflated throughout, narrowly to broadly ovoid, about 0.15 mm. long and 0.06–0.1 mm. wide when well developed, keel straight to slightly arched, free margin involute to beyond the apex, sinus and apical tooth as in allied species; lobule usually poorly developed; cells of lobe about $23\ \mu$ wide along the margin, $44 \times 32\ \mu$ in the middle and $55 \times 34\ \mu$ at the base, thin-walled throughout or with minute trigones having concave sides, intermediate thickenings, scarcely or not at all developed, cuticle smooth; underleaves contiguous to loosely imbricated, convex from below, the lateral margins often involute, orbicular, mostly 0.8–1.2 mm. long, bifid one fourth or less with a narrow, usually sharp sinus and broad, acute to obtuse, contiguous or overlapping divisions, cordate to auriculate at base, the auricles sometimes contiguous but rarely if ever overlapping, margin minutely crenulate from projecting cells; inflorescence autoicous: ♀ inflorescences borne on a more or less elongated and usually repeatedly floriferous branch-systems, each subtended by one or, rarely, two innovations, the latter often bearing a second flower after a single vegetative leaf and underleaf, complicated

cymose inflorescences being thus formed; bracts slightly spreading, scarcely keeled, the lobe straight (not falcate), ovate, mostly 0.85–1.1 mm. long and 0.35–0.55 mm. wide, acute and usually irregularly toothed, the teeth small, sharp or blunt, rarely more than three or four and often vague or indistinct, lobule usually indistinct, represented by a short and narrow basal fold, the apex rarely distinguishable but sometimes acute; bracteole free or nearly so from the bracts, ovate to obovate, mostly 0.7–1 mm. long and 0.45–0.6 mm. wide, bifid about one fourth with a narrow acute sinus and erect, acute lobes, the margins as, in the underleaves, rarely with a median sharp or blunt tooth on one or both sides; perianth more or less exserted, sometimes for about half its length, obovoid and often narrowly so, mostly 0.6–0.75 mm. long and 0.3–0.35 mm. wide, cuneate toward the base and truncate at the apex with a rather long beak, five-keeled in the upper third, the keels sometimes rounded and indistinct but often sharper and more or less distinctly winged, a wing sometimes bearing one or two short and irregular teeth: ♂ inflorescence occupying a short branch, usually arising in a ♀ inflorescence branch-system, sometimes in the form of a subfloral innovation, apparently never proliferating; bracts mostly in one to five pairs, imbricated, much smaller than the vegetative leaves, strongly inflated, shortly bifid with blunt or subacute lobes and a strongly arched keel; antheridia in pairs; bracteole mostly single, very small, ovate bifid about one third with subacute lobes: mature sporophyte about 0.2 mm. in diameter. [TEXT-FIGS. 12–22.]

On wet rocks; range incompletely known. The following specimens have been examined:

JAMAICA: near spring and waterfall, vicinity of Moody's Gap, September, 1908, *E. G. Britton* 938; on wet rocks, Hardware Gap and vicinity, July, 1903, *A. W. Evans* 204; on wet rocks, Doll Wood, August, 1906, *A. W. Evans* 485; on *Asplenium alatum* H. B. K., growing on wet rocks, trail from Morce's Gap to Vinegar Hill, March, 1920, *Maxon & Killip* 1318a.

COLOMBIA: Cerra de Onaca, August, 1898, *H. H. Smith* "D."

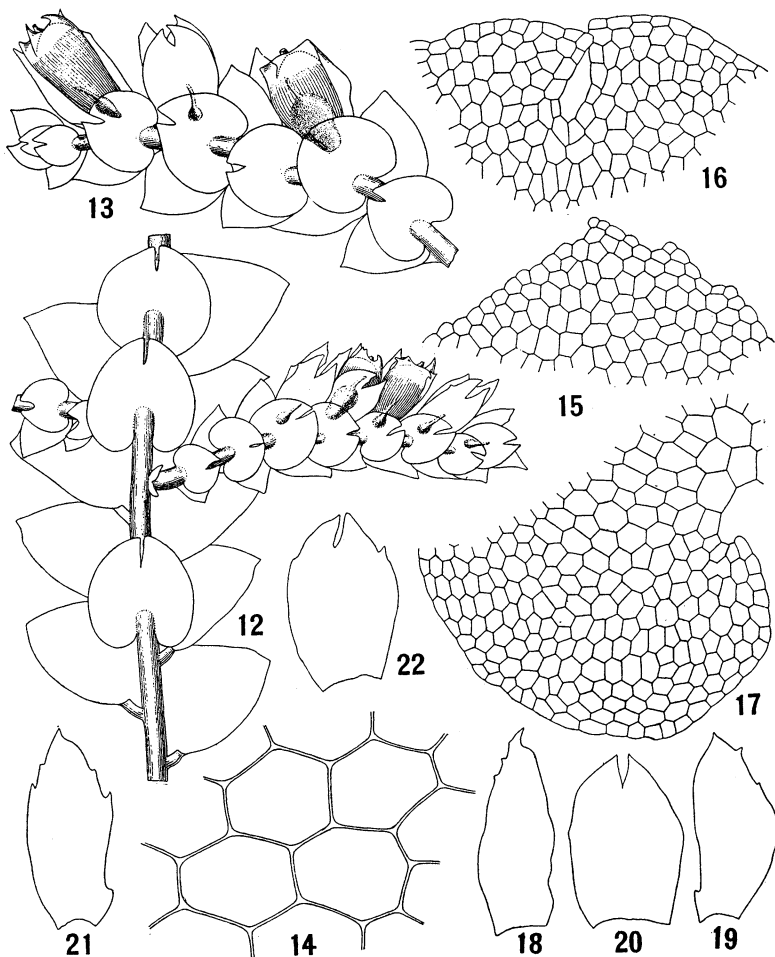
Mrs. Britton's specimen from Moody's Gap, Jamaica, No. 938, may be designated the type.

The branch-systems upon which the female inflorescences are borne sometimes attain a high degree of complexity and constitute one of the distinctive features of the species. In their simpler states these branch-stysemes resemble those of *T. jamaicen-*

sis, although usually with fewer leaves. One of those examined bore two underleaves with the corresponding leaves and then a perianth with its involucral leaves; the subfloral innovation arising at the base of the inner bract bore a single leaf and underleaf and then a second perianth; this process was repeated twice, the subfloral innovation borne below the last inflorescence being simple and very rudimentary. In this way a one-sided cymose inflorescence was formed with four crowded perianths along its upper side. Similar, relatively simple branch-systems are shown in FIGS. 12 and 13, both of which were drawn from the same plant; in FIG. 12, five crowded inflorescences are present; in FIG. 13, three.

In contrast to this example a relatively complex branch-system may now be considered. In one of those studied the original branch bore two underleaves and a female inflorescence, just as in the first example, and the subfloral innovation was tipped with a second female inflorescence after bearing a single leaf and underleaf; the first inflorescence, however, bore a second innovation in the form of a short male spike at the base of its outer bract, and the second female inflorescence bore a female branch in the same position, thus lying in a fork between its two innovations. The first of these innovations (that arising at the base of the outer bract) bore two underleaves (with their corresponding leaves) and then a perianth with its bracts, innovating on its inner side; the innovation thus formed bore an underleaf, a leaf with a short male spike at its base and then another unfertilized female flower with two subfloral innovations—one a short male spike and the other a female branch, bearing a third female inflorescence after forming three underleaves with the corresponding leaves. Beyond this third female inflorescence, which remained unfertilized a fourth and fifth, both unfertilized and borne on very short innovations, were developed, the branch-system being brought to a conclusion by a sterile and rudimentary innovation, just as in the case of the first branch-system described. The second innovation of the second female inflorescence was similar to the first bearing in all four female inflorescences and a single male spike, the latter arising as a subfloral innovation. This example, which bore thirteen female inflorescences in all, will give some idea of the complexities encountered, although an even more intricate condition might have been selected for description.

The perianth of *T. densiflora* (FIGS. 12 and 13) exhibits a considerable range of variability, this sometimes manifesting



TAXILEJEUNEA DENSIFLORA Evans

12. Part of a stem showing a female branch-system, ventral view, $\times 15$. 13. Another female branch-system from the same stem, ventral view, $\times 25$. 14. Cells from middle of lobe, $\times 265$. 15. Apex of lobe, $\times 90$. 16. Apex of underleaf, $\times 90$. 17. Basal auricle of underleaf, $\times 90$. 18-20. Bracts and bracteole from a single inflorescence, $\times 35$. 21, 22. Bract and bracteole from another inflorescence, $\times 35$. The figures were all drawn from the type specimen.

itself on a single plant or even on a single inflorescence branch-system. It broadens out in all cases from a narrow base and,

as it becomes old, is sometimes (as in so many other Lejeuneae) raised on a stalk representing an elongation of that portion of the female branch situated between the involucre and the perianth. In the lower part the perianth is terete but in the upper part five more or less distinct keels are present, the dorsal keel being sometimes less developed than the others. These keels may be nothing more than angular or rounded projections, but in most cases one or more of them will show a more or less distinct wing. These wings, in turn, may consist of nothing more than one or two projecting and rounded cells, but in their best development, although still remaining short and narrow they sometimes show from one to three sharp teeth, one or two cells long. Between these two extremes are many transitional conditions. In the upper part the perianth is truncate but the angles are either sharp or blunt according to the nature of the keels; sometimes a perianth will be sharp on one side and rounded on the other. The keel is slender and rather long, being composed (when well developed) of four superimposed circles of cells. When the perianths become old and especially after the capsules have been extruded, the upper part becomes stretched out and lacerated, although it never assumes the strikingly companulate form found in *T. sulphurea* and its allies.

A comparison of FIGS. 12 and 13 with FIG. 1 and also with PLATE 1, FIGS. 1 and 2, will show how strikingly the vegetative organs of *T. densiflora* resemble those of *T. pterogonia* and *T. jamaicensis*. The leaves, to be sure, spread at a somewhat greater angle and the auricles of the lobes (not shown in the figures) and of the underleaves tend to be less pronounced than in *T. pterogonia*, agreeing better with *T. jamaicensis*, but FIG. 17 shows that sometimes at least the auricles of the underleaves are well developed. There is moreover a tendency for the leaves and the divisions of the underleaves to be blunter, and a prolonged search is sometimes necessary before a leaf tipped with two superimposed cells can be demonstrated. The dentations on the leaves, when present, show a similar tendency to be blunt rather than sharp. The sinus of the underleaves is similar in all three species and of about the same length. In *T. densiflora*, however, rounded sinuses are somewhat more frequent and the

sides of the sinus are usually bounded by only six or seven cells instead of by eight to ten as in *T. pterogonia* and *T. jamaicensis*. It will be seen at once that all these differences are vague and unsatisfactory, being found in very variable organs.

A more important distinction is found in the greater size of *T. densiflora*. This is indicated by comparing FIG. 1 with FIG. 12, the latter of which is magnified about 40 per cent more. The leaf-cells are also considerably larger (compare FIG. 14 with PLATE —, FIG. 4) and are further distinguished by their very poorly developed thickenings. The trigones in fact are often absent altogether and, even when present, are minute and have concave sides, so that they can be discerned only with difficulty. Intermediate thickenings are absent altogether or very vaguely indicated, and there seems to be no trace of the minute verruculae found in the other two species. Perhaps the poorly developed thickenings are associated with the wet conditions under which the species develops.

The bracts and bracteoles (FIGS. 18–22), except for their larger size and laxer structure, have little to distinguish them from those of *T. jamaicensis*, and it has already been shown how vague the distinctions are between this latter species and *T. pterogonia*. In *T. densiflora* it is rare to find a bract which is wholly without teeth, although these may be very vague, and the lobule is rarely anything more than a basal fold, with or without a distinct apex. The teeth on the sides of the bracteole are somewhat less in evidence than in either of the other two species.

4. TAXILEJEUNEA DEBILIS (Lehm. & Lindenb.) Steph.

Jungermannia debilis Lehm. & Lindenb. in Lehmann, Pug. Plant. 4: 51. 1832.

Lejeunea debilis Nees & Mont. Ann. Sci. Nat. Bot. II. 5: 60. 1836.

Omphalanthus debilis Lehm. & Lindenb. in G. L. & N. Syn. Hep. 306. 1845.

Omphalanthus martinicensis Gottsche, Ann. Sci. Nat. Bot. V. 1: 149. 1864 (in obs.).

Lejeunea (*Taxilejeunea*) *debilis* Steph. Hedwigia 29: 141. 1896.

Taxilejeunea martinicensis Steph. Hedwigia **35**: 135. 1896.

Taxilejeunea debilis Steph. Sp. Hepat. **5**: 451. 1913.

Pale yellowish or whitish green growing in loose mats, often pure but sometimes in admixture with other bryophytes: stems mostly 0.15–0.2 mm. in diameter, irregularly and usually sparingly branched, the branches obliquely spreading usually with smaller leaves than the stem: leaves loosely imbricated, the lobe obliquely spreading, plane to strongly convex, scarcely falcate, ovate, mostly 1–1.2 mm. long and 0.9–1 mm. wide, dorsal margin arching across the stem and distinctly auriculate at the base, margins and apex of lobe, features of lobule and leaf-cells much as in *T. jamaicensis*; underleaves contiguous to loosely imbricated, convex (from below) and often involute, orbicular, mostly 0.06–1 mm. long, the basal auricles and margin much as in *T. jamaicensis* but the apical sinus often bluntly pointed to lunulate instead of being narrow and acute and the segments usually sharper and sometimes tipped with two cells: inflorescence dioicous: ♀ inflorescence sometimes borne on a short branch sometimes on a more elongated branch, innovating on one side, the innovation usually only once floriferous; bracts somewhat spreading, keel rounded, lobe straight not falcate, ovate to oblong, mostly 0.65–0.9 mm. long and 0.3–0.45 mm. wide, acute, often irregularly toothed, the teeth mostly sharp and sometimes consisting of single projecting cells, usually only three or four, lobule sometimes distinct but often scarcely evident, mostly 0.15–0.2 mm. long and 0.05–0.07 mm. wide; bracteole free or nearly so from the bracts, obovate to oblong, mostly 0.7–0.9 mm. long and 0.45–0.65 mm. wide, bifid about one third with a narrow sinus and erect acute divisions, margin crenulate and sometimes bearing a sharp tooth on one or both sides; perianth more or less exserted, obovoid, mostly 0.75–0.85 mm. long and 0.45 mm. wide, cuneate toward the base and truncate at the apex with a short beak, five-keeled in the upper part, the keels crenulate from projecting cells but without wings or teeth: ♂ inflorescence as in *T. pterogonia*.

On banks and rocks, more rarely on logs; widely distributed in tropical America. The specimens listed have all been personally examined by the writer; several of the determinations have unfortunately been made from sterile material, but this has usually been abundant and in good condition. A few other records for the species will be noted later.

MEXICO: without definite locality, *F. Liebmann* (Underwood Herbarium, from Sullivant Herbarium); Orizaba, 1887, *C. Mohr*

(Underwood Herbarium); Zacuapan, Vera Cruz, 1908, *C. A. Purpus* 5540, 5541.

GUATEMALA: near the Finca Sepacuité, Alta Verapaz, 1902, *Cook & Griggs* 75, 443; trail between Sepacuité and Pangos, Alta Verapaz, 1905, *Maxon & Hay* 3112; trail between Sepacuité and Secanguin, Alta Verapaz, 1905, *Maxon & Hay* 3117; Cubelquitz, Alta Verapaz, 1906, *H. von Türckheim* 5104 (Bryotheca E. Levier).

NICARAGUA: Volcan Mombacho, Department of Granada, 1903, *C. F. Baker* 2505 in part (Plants of Pacific Central America).

COSTA RICA: La Esmeralda, Massif da Barba, 1892, *P. Biolley* 15628 (herbarium of the New York Botanical Garden).

JAMAICA: Beaufort Hill, Westmoreland Hills, New Market, 1907, *Britton & Harris* 598; Dolphin Hill and vicinity, 1908, *N. L. Britton* 2335.

MONTSERRAT: Pond Mountain, 1907, *J. A. Shafer* 870.

GUADELOUPE: without definite locality or date, *L'Herminier*; Grand-Marron, 1902, *Père Duss* 1026 (distributed as *T. caripensis* Gottsche).

MARTINIQUE: various localities, 1897-1900, *Père Duss* 8, 19, 118, 133, 179, 210, 593, 616 (herbarium of the New York Botanical Garden); between St. Pierre and Champflore, 1868 *T. Husnot* (Pl. des Antilles 243, as *Omphalanthus martinicensis* Gottsche).

ST. VINCENT: without definite locality or date, *L. Guilding* (Mitten Herbarium).

TRINIDAD: Mt. Tocuche, 1920, *Britton, Coker & Rowland* 1486, 1494 in part, 1498; Maracas Waterfall, 1920, *Britton, Hazen & Coker* 1678.

PERU: San Miguel, 1911, *H. W. Foote* (listed by the writer in Trans. Connecticut Acad. 18: 315. 1914).

In their description of *Jungermannia debilis* the original authors, Lehmann and Lindenberg, state that the leaves are semivertical, obliquely cordate, acuminate, entire or bidentate at the apex, decurrent at the base and shortly complicate, adding that the stems appear filiform on account of the inflexion of the leaves. They describe the underleaves as equalling the leaves in

size, cordate-oval in form, subpeltate (in allusion to the strongly arched line of attachment), and more deeply emarginate than the leaves, the sinus being narrow and the laciniae acute.

This original description was drawn from sterile material collected on the island of St. Vincent, the name of the collector not being mentioned. Although the type has not been examined by the writer, a specimen in the Mitten Herbarium, which apparently represents a co-type, has been carefully studied. This specimen was collected on St. Vincent by L. Guilding and came originally from the Hooker Herbarium. It agrees in all essential respects with the original description, except that the leaves are acute or apiculate rather than "acuminate," indicating that the latter term was not well chosen. It agrees also with the other specimens listed above, so far as this can be established in the absence of female branches and perianths.

Unfortunately most of the important differential characters of the species, as here delimited, are based on these very parts, and the vegetative characters of *T. debilis* are largely duplicated in *T. pterogonia*, *T. jamaicensis* and (to a less extent) *T. densiflora*. In other words all four species show auricles at the base of the leaves and underleaves; acute for apiculate leaf-lobes, crenulate throughout and often sparingly dentate in the apical portion; and a short apical sinus on the underleaves with more or less sharp-pointed divisions. Both *T. pterogonia* and *T. jamaicensis*, moreover, show a cell-structure which is essentially like that of *T. debilis*, the trigones, intermediate thickenings and superficial verruculae being much the same. Under the circumstances it might at first seem justifiable to give up the name *T. debilis* altogether, regarding the sterile type as indistinguishable from the allied species. When the underleaves are carefully compared, however, the apical sinus of *T. debilis* is seen to be frequently rounded or lunulate, whereas this condition is rarely found in *T. pterogonia*, *T. jamaicensis* or *T. densiflora*. On the basis of this vague and not too constant difference the validity of *T. debilis* may still be maintained and the determination of sterile material may be attempted.

In the specimens here referred to *T. debilis* underleaves with rounded or lunulate sinuses are associated with five-keeled peri-

anths destitute of both wings and teeth.* As the citations show specimens of this type are widely distributed in the Lesser Antilles, whereas (according to our present knowledge) specimens with toothed or winged keels have not yet been found there. It is to be regretted that authors have associated the name *T. debilis* with specimens in which the keels of the perianth are toothed and often winged, thus giving rise to much confusion. As the history of the species will show their conception of its characters was drawn largely from continental material, rather than from material collected in the West Indies.

Four years after its original publication *Lejeunea debilis* was recorded from "Peru" by Nees von Esenbeck and Montagne, neither the definite locality nor the collector's name being mentioned. These authors, in their description, make no mention of floral organs, thus implying that their new material was likewise sterile, but they amend some of the phrases of the original description. They state, for example, that the leaves are narrowed at the apex but that they may be obtuse, acute or truncate-subbidentulate, and they state further that the divisions of the underleaves may sometime be obtuse. Three years later Montagne† gave a fuller account of these same specimens, stating that that they were collected by A. d'Orbigny between Chupé and Yanacaché in the province of Yungas, in Bolivia, thus indicating that they did not come from Peru in the modern sense. Montagne described the female branches and floral organs from the Bolivian material (showing that it was really fertile) and figured various structural details. According to his account the inflorescences are borne on very short branches, one to three being present on a branch; the perianth is obovate-oblong or pyriform, five-angled at the dilated apex, the angles being compressed and dentate; the bracts are irregularly dentate, sometimes bifid at the truncate apex; and the bracteole is repand-dentate and more deeply bifid

* A somewhat ambiguous statement by Lehmann and Lindenberg may here be mentioned. To their description of *J. pterogonia* they add a note in which they compare this species with their *J. debilis* and also with *J. isocalycina* Nees, to both of which they apparently assign a smooth perianth without keels. In all probability however, they meant this to apply to *J. isocalycina* alone, since they had distinctly stated in their description of *J. debilis* that the fruit was lacking.

† D'Orbigny, Voy. l'Amér. Mérid. 7²: 65. pl. 1, f. 2. 1839.

at the apex [than the underleaves], the divisions being "acuminulate" and connivent. The figures are not altogether successful and fail to show distinct basal auricles in either leaves or underleaves. Montagne himself criticises the figure showing a female branch-system, stating that the features of the perianths are not well brought out. The branch-system in the figure shows a rather long branch with five perianths, but it is impossible to learn from it the sequence in which the inflorescences arose. The figure of a single perianth, dissected open, shows distinct teeth in the upper part.

In the Mitten Herbarium there is a specimen of "*Omphalanthus debilis*" from "Peru" received from Montagne. In all probability this represents a part of D'Orbigny's Bolivian material, although no information to this effect is given on the label. The specimen shows short female branch-systems, usually with two inflorescences on each and five-keeled perianths with the keels distinctly toothed. They thus agree with Montagne's statements. In the writer's opinion, however, this specimen should be referred to *T. pterogonia* (where it is already listed), rather than to *T. debilis*, in spite of the fact that Montagne's determination has heretofore been accepted without question.

The authors of the Synopsis Hepaticarum, in 1845, incorporated Nees von Esenbeck and Montagne's corrections and additions in their description of *Omphalanthus debilis*, although they comment adversely on Montagne's figures. In the supplement to the Synopsis, published two years later (p. 746), they quote in full Montagne's description of the floral organs, but in their own description they improve his phrase relating to the keels of the perianth by describing them as cristate-dentate. They apparently gained their idea of the floral organs entirely from specimens collected on the mainland, since the only West Indian specimen cited is the sterile type from St. Vincent. The authors clearly accepted the species in a rather broad sense, since they distinguished and in most cases briefly characterized the following forms: α , *originalis* (St. Vincent, the original specimens); α^* , *Liebmanianus* (Mirador and Zacuapan, Mexico, *Liebmann* 27, 539a); α^{**} (Amatian, Mexico, *Liebmann* 309); β , *angustior* (Hacienda da Jovo, Mexico, *Liebmann* 515); γ , *Orbignianus* ("Peru," D'Orbigny

in Herb. Montagne); and γ^* , *columbicus* (Merida and Tovar, Venezuela, Moritz 83). The suspicion is thereby aroused that their *O. debilis* may have been an aggregate.

Gottsche, in his Mexikanske Levermossor (p. 272), adds further details about *O. debilis*, and especially about the Mexican specimens. He states that these are somewhat smaller than the St. Vincent specimens and gives measurements of the leaves and underleaves in α^* *Liebmanianus* (539a) and in α^{**} (309), as follows: lobes, 0.8–1 x 0.75–0.85 mm.; lobules, 0.13 x 0.1 mm.; underleaves 0.8–1 x 0.75–1 mm. He calls attention also to the crenulate margins of the leaves and underleaves.

In Stephani's revision of the Lindenberg specimens he accepts as correctly determined most of those listed in the Synopsis, so far as these are represented. The only exception is the γ , *columbicus*, which he regards as a mixture of *T. debilis* and *T. pterogonia*, as already noted under the latter species.* He cites *T. debilis* further from Martinique† and also from Guadeloupe, thus ascribing to it a wide geographical distribution in both North and South America. In his Species Hepaticarum (p. 463), however, where he assigns a dioicous inflorescence to the species, he restricts its range to the "Insulae antillanae," but does not state what disposition he makes of the Mexican, Venezuelan and "Peruvian" specimens which he had formerly referred to *T. debilis*. Neither does he indicate in any way which specimens served as the basis for his description of the perianth and involucre leaves. On the whole his account of the perianth does not differ greatly from that of Montagne; he states that it is clavate, three times as long as wide, truncate at the apex and armed with very irregular laciniae, adding that the ventral keels are short, widely divergent and similarly armed, and that the beak is long and slender. His account of the bracts is more at variance; he describes the lobe as narrowly lanceolate, about half as long as the perianth, acute and entire; and the lobule as small, linear, obtuse and not discrete from the lobe.

* His statements regarding γ , *columbicus*, have since been confirmed by Schiffner (Bot. Jahrb. 23: 579. 1897).

† In the Synopsis a specimen from Martinique (in the Hampe Herbarium) is listed but, in the supplement, doubt is thrown on the correctness of the determination. Whether or not this is the specimen studied by Stephani does not appear.

Other allusion to *T. debilis* in the literature add very little to our knowledge of the species. Gottsche* mentions it briefly in connection with his *Omphalanthus laevis* and *O. leioscyphus* from Colombia, and Spruce,† in connection with his *Lejeunea* (*Taxi-Lejeunea*) *chimborazensis* from Ecuador. It is listed also, without comment, by Bescherelle‡ from Martinique, by Duss§ from the same island, and by the writer from Peru.§ Several of the specimens recorded from the French Antilles have been verified. Although the species is known from so many of the Lesser Antilles it is not listed by Spruce¶ in his account of the Hepaticae collected by W. R. Elliott on the islands of Dominica and St. Vincent. It is rather remarkable that it has not been found on the latter island since the time of Guilding.

T. martinicensis, which is here included among the synonyms of *T. debilis*, was based on material collected by L'Herminier on the island of Martinique. When Stephani published it in 1896 he made no mention of Gottsche as author, but in his *Species Hepaticarum* (5: 472), seventeen years later, he cited "*Omphalanthus martinicensis* Gottsche ms." as a synonym. Strictly speaking this name is not wholly a manuscript name. It was published in 1864 by Gottsche (as already noted in the synonymy), in connection with his *Omphalanthus leioscyphus* from Colombia. Although he gave no formal description of his *O. martinicensis* he distinguished it from *O. debilis* (to which he considered it allied) by its smooth perianth and entire bracts, and also pointed out numerous differences between *O. martinicensis* and *O. leioscyphus*. The name *O. martinicensis* appears also in Husnot's catalogue of the bryophytes collected in the French Antilles, where the specimens distributed in his "Plantes des Antilles" are enumerated.** These specimens were determined by Gottsche and the one issued under the name *O. martinicensis* presumably agrees with L'Herminier's type. Although Gottsche apparently knew his species from

* Ann. Sci. Nat. Bot. V. 1: 148. 1864.

† Trans. Bot. Soc. Edinburgh 15: 216. 1884.

‡ Jour. de Bot. 7: 179. 1893.

§ Enum. méth. Musc. Ant. Franç. I. Hépatiques 8. Lons-le-Saunier. 1903.

¶ Trans. Connecticut Acad. 18: 315. 1914.

¶ Jour. Linn. Soc. Bot. 30: 331-372. pl. 20-30. 1894.

** Rev. Bryol. 2: 3. 1875.

Martinique only, Stephani (in his *Species Hepaticarum*) gives as its habitat, "India occidentalis," adding that it is very common.

Stephani's descriptions of *T. martinicensis* are full and clear. He assigns to the species a dioicous inflorescence; contiguous, obliquely spreading, ovate-oblong leaves, acute or apiculate at the apex and sparingly dentate in the apical portion (entire or obliquely truncate-bidentate according to his 1896 description); a small ovate lobule, equalling the diameter of the stem and acutely angled at the truncate apex; cells measuring $36\ \mu$ in the middle of the leaf and $36 \times 54\ \mu$ in the basal portion, with scarcely evident trigones; underleaves surpassing the leaves in size, cordate at the base (the basal auricles rotund and not connivent), and narrowly incised at the apex with an obtuse sinus and "acuminate acute" divisions; lanceolate (or ovate-lanceolate), entire and acute bracts, half the length of the leaves and with a short, linear acute or obtuse lobule, not discrete from the lobe; an obovate-obconic bracteole, as long as the bracts but twice as wide, one third incised-bilobed with a "straight" sinus and triangular, acuminate acute divisions (connivent and sometimes sparingly toothed in the 1896 description); and a small obovate-oblong perianth (measuring 1×0.6 mm.), truncate and obsoletely beaked at the apex, five-angled in the upper part, the angles or keels being entire.

If Stephani's descriptions of *T. martinicensis* are compared with his account of *T. debilis* it will be seen that the only important differences brought out are those derived from the perianth. In the herbarium of the New York Botanical Garden there is a fine series of *T. debilis*, collected by Père Duss on Martinique and determined by Stephani. Some of these specimens are completely sterile or show male inflorescences only; others are female and in some cases show well-developed perianths. So far as the writer has been able to observe these organs are invariably five-angled and destitute of wings and teeth. It is clear therefore that Stephani did not hesitate to refer to *T. debilis* plants which showed the perianth-characters of *T. martinicensis*. The study of the specimens of *T. martinicensis*, distributed by Husnot, shows that obtuse leaves are of occasional occurrence; that the auricles of the underleaves are sometimes so well developed that they almost

touch; that similar auricles (not mentioned by Stephani) are present on the leaves; that the thickenings in the cell-walls are sometimes better developed than he implies; and that surface-verruculae can almost always be demonstrated. Unfortunately this specimen is destitute of female inflorescences, but the evidence of variation which it exhibits serves to break down still further the distinctions between *T. martinicensis* and *T. debilis*, and the writer has no hesitation in considering them synonymous.

Another species which is clearly in need of further study is *T. dissitifolia* Steph.,* based on a specimen collected by Père Duss on the island of Guadeloupe. This species is known to the writer from description only, and Duss states, in listing it, that his own specimen is lost. So far as the description goes there is nothing to distinguish *T. dissitifolia* from *T. debilis* as here described, and the writer is inclined to regard the two species as synonymous. In the absence of specimens, however, it is impossible to reach a definite conclusion.

The close relationship existing between *T. debilis* and the three other species treated in the present paper has already been emphasized. Perhaps the closest relative of all is *T. jamaicensis*, and it was with some hesitation that the writer decided to propose the latter species as new. Aside from the difference in the underleaves, however, *T. debilis* is distinguished from *T. jamaicensis* by its dioicous inflorescence and by the constant absence of wings and teeth on the keels of the perianth. The dioicous inflorescence is of course associated with frequent sterility. Many specimens have been collected in which no trace of sexual organs can be detected and even in female material perianths are often lacking. In the case of *T. jamaicensis* the presence of perianths can usually be demonstrated by careful examination.

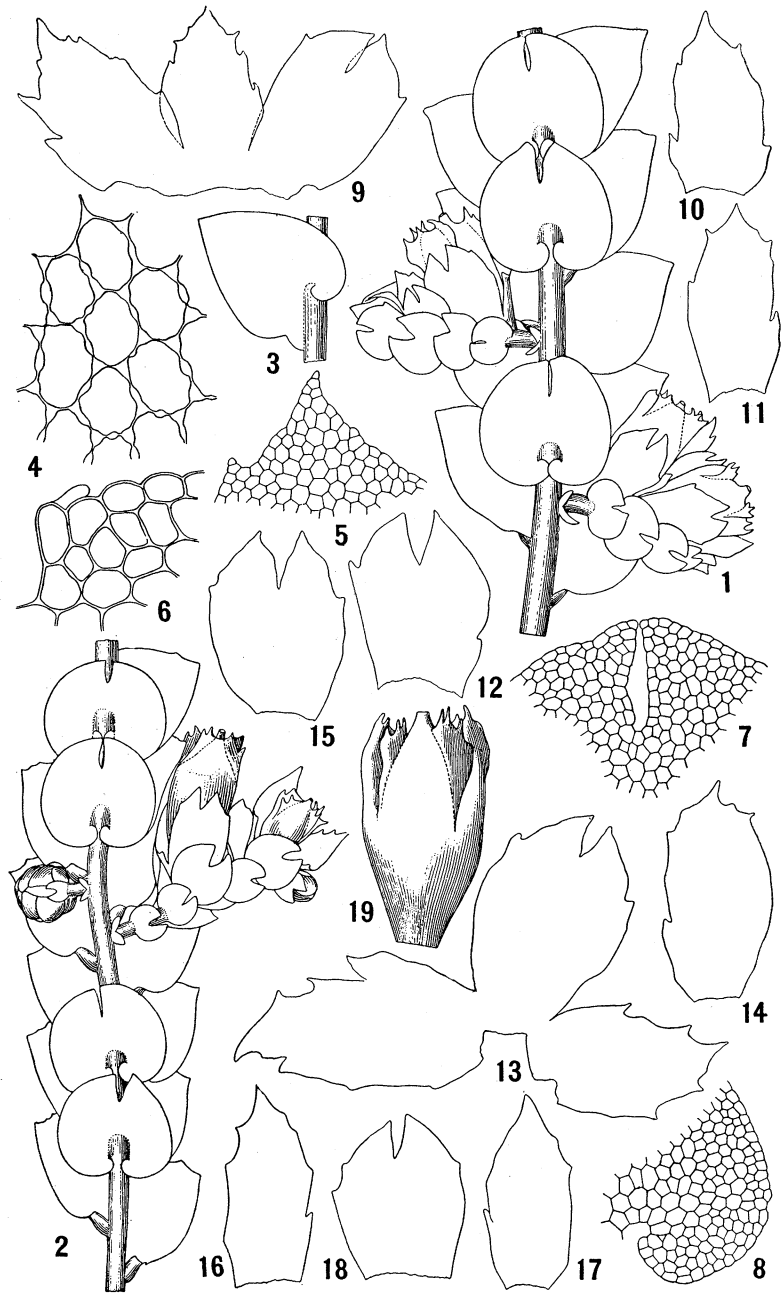
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* Symb. Antillanae 2: 472. 1900. Not "Hedw., 1900, p. 472," as cited by Stephani in his Species Hepaticarum (5: 464. 1913).

Explanation of plate 2

TAXILEJEUNEA PTEROGONIA (Lehm. & Lindenb.) Schiffn.

1. Part of a stem showing two female branch-systems, ventral view, $\times 25$.
2. Part of a stem showing a female branch-system and a male inflorescence, ventral view, $\times 25$. 3. Leaf, dorsal view, $\times 25$. 4. Cells from middle of lobe, $\times 265$.
5. Apex of lobe, $\times 90$. 6. Apex of lobule, $\times 265$. 7. Apex of underleaf, $\times 90$.
8. Basal auricle of underleaf, $\times 90$. 9. Bracts and bracteole from a fertilized inflorescence, the bracteole at the right, $\times 45$. 10-12. Bracts and bracteole from another fertilized inflorescence (the second) of the same branch-system, $\times 45$.
13. Bracts and bracteole from a fertilized inflorescence of another branch-system, $\times 45$. 14, 15. Bract and bracteole from an unfertilized inflorescence of the same branch-system, $\times 45$. 16-18. Bracts and bracteole from another inflorescence, $\times 45$.
19. Perianth, $\times 45$. FIGS. 1, 3-15, and 19 were drawn from specimens collected at San Miguel, Peru, by Cook & Gilbert (1180); FIGS. 2 and 16-18, from specimens collected in the vicinity of Moody's Gap by E. G. Britton (916).



TAXILEJEUNEA PTEROGONIA (LEHM. & LINDENB.) SCHIFFN.